PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2001-283428**

(43)Date of publication of application : **12.10.2001**

(51)Int.Cl. G11B 5/738
G11B 5/64
G11B 5/66

(21)Application number : **2000-094552**

(22)Date of filing : **30.03.2000**

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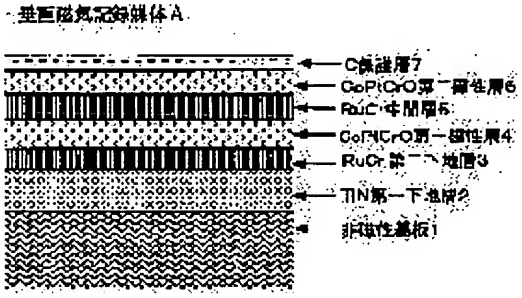
(54) PERPENDICULAR MAGNETIC RECORDING MEDIUM AND PERPENDICULAR MAGNETIC RECORDING/REPRODUCING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a perpendicular magnetic recording medium reduced in medium noise and a perpendicular magnetic recording/reproducing device.



SOLUTION: This perpendicular magnetic recording medium consists of a nomnagnetic substrate, an underlaid layer formed on the nomnagnetic substrate, a magnetic layer formed on the underlaid layer and a protection layer formed on the magnetic layer. The magnetic layer consists of an alloy containing Co as the principal component and the underlaid layer consists of an alloy containing the material having a body-centered cubic structure formed with Ru as the principal component and contains 60 atomic % or more Ru. As a result, the disarrangement of the crystal orientation is restrained and the perpendicular orientation is enhanced when the crystals of the magnetic layer are grown at the initial stage. In addition, the crystal grains in the magnetic layer can be made minute and the grain size can be made uniform and subsequently the medium noise can be reduced.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In the vertical-magnetic-recording medium which consists of a nonmagnetic substrate, the substrate layer formed on said nonmagnetic substrate, a magnetic layer formed on said substrate layer, and a protective layer formed on said magnetic layer The vertical-magnetic-recording medium which said magnetic film consists of an alloy which uses Co as a principal component, and is the alloy with which said substrate layer uses as a principal component the ingredient which has Ru and body-centered cubic structure, and is characterized by including Ru more than 60at(s).%.
[Claim 2] In the vertical-magnetic-recording medium which consists of a nonmagnetic substrate, the first substrate layer formed on said nonmagnetic substrate, the second substrate layer formed on said first substrate layer, a magnetic layer formed on said second substrate layer, and a protective layer formed on said magnetic layer Said magnetic layer consists of an alloy which uses Co as a principal component, and said first substrate layer consists of the alloy or compound which uses Ti or Ti as a principal component. The vertical-magnetic-recording medium which is the alloy with which said second substrate layer considers the ingredient which has Ru and body-centered cubic structure as a part for a principal component, and is characterized by including Ru more than 60at(s).%.
[Claim 3] The vertical-magnetic-recording medium according to claim 1 characterized by the ingredient which has said body-centered cubic structure in said substrate layer consisting of a kind of element of the groups which consist of Cr, V, Nb, Mo, Ta, and W at least.
[Claim 4] The vertical-magnetic-recording medium according to claim 2 characterized by the ingredient which has said body-centered cubic structure in said second substrate layer consisting of a kind of element of the groups which consist of Cr, V, Nb, Mo, Ta, and W at least.
[Claim 5] The vertical-magnetic-recording medium according to claim 1 by which the ingredient which has said body-centered cubic structure in said substrate layer makes it **** to be Cr.
[Claim 6] The vertical-magnetic-recording medium according to claim 2 by which the ingredient which has said body-centered cubic structure in said second substrate layer is characterized by being Cr.
[Claim 7] 7 is [claim 1 to which said magnetic layer is characterized by including Pt, Cr, and O further thru/or] the vertical-magnetic-recording medium of a publication either.
[Claim 8] 6 is [claim 1 characterized by consisting of an interlayer whom said magnetic layer turns into from the alloy which uses as a principal component the first magnetic layer which uses Co as a principal component, Ru formed on said first magnetic layer, and the ingredient which has body-centered cubic structure, and contains Ru more than 60at(s).%, and the second magnetic layer used as Co principal component formed on said interlayer thru/or] the vertical-magnetic-recording medium of a publication either.
[Claim 9] The vertical-magnetic-recording medium according to claim 8 by which said first magnetic layer and said second magnetic layer are characterized by including Pt, Cr, and O further.
[Claim 10] 9 is [claims 2, 4, and 6 characterized by said first substrate layer consisting of a nitride of Ti or Ti thru/or] account ****** of the perpendicular MAG of a publication either.
[Claim 11] Claims 1, 3, 5, 7, 8, and 9 characterized by preparing a soft magnetism layer further between

said substrate layers and said nonmagnetic substrates are the vertical-magnetic-recording media of a publication either.
[Claim 12] 10 is [claims 2, 4, and 8 characterized by preparing a soft magnetism layer further between said first substrate layers and said nonmagnetic substrates thru/or] the vertical-magnetic-recording medium of a publication either.
[Claim 13] A vertical-magnetic-recording medium and the driving means which supports and drives [rotation] said vertical-magnetic-recording medium, A magnetic-recording playback means to perform informational record and playback to said vertical-magnetic-recording medium, It is a vertical-magnetic-recording regenerative apparatus possessing the support means which supports said record playback means free [migration] to said vertical-magnetic-recording medium. Said vertical-magnetic-recording medium A nonmagnetic substrate, The substrate layer formed on said nonmagnetic substrate, and the magnetic layer formed on said substrate layer, The vertical-magnetic-recording regenerative apparatus which the protective layer formed on said magnetic layer is provided, and said magnetic layer consists of an ingredient which uses Co as a principal component, and is the alloy with which said substrate layer uses as a principal component the ingredient which has Ru and body-centered cubic structure, and is characterized by including Ru more than 60at(s).%.
[Claim 14] A vertical-magnetic-recording medium and the driving means which supports and drives [rotation] said vertical-magnetic-recording medium, A magnetic-recording playback means to perform informational record and playback to said vertical-magnetic-recording medium, It is a vertical-magnetic-recording regenerative apparatus possessing the support means which supports said record playback means free [migration] to said vertical-magnetic-recording medium. Said vertical-magnetic-recording medium consists of an alloy with which said magnetic layer uses Co as a principal component. The vertical-magnetic-recording regenerative apparatus which said first substrate layer consists of the alloy or compound which uses Ti or Ti as a principal component, and is the alloy with which said second substrate layer uses as a principal component the ingredient which has Ru and body-centered cubic structure, and is characterized by including Ru more than 60at(s).%.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the vertical-magnetic-recording medium and vertical-magnetic-recording regenerative apparatus suitable for high density magnetic recording.
[0002]
[Description of the Prior Art] Conventionally, by the vertical-magnetic-recording medium using the magnetic layer which uses Co as a principal component, in order to improve the magnetic properties and record reproducing characteristics to ****, the attempt which uses various ingredients as a substrate layer of a magnetic layer, and controls crystal orientation, a diameter of crystal grain, segregation structure, etc. of a magnetic layer has been made.
[0003] For example, in JP,2-73511,A or JP,5-73877,A, using one or more sorts of ingredients, such as Ru and Cr, for the substrate layer of the magnetic layer of Co system is indicated. The substrate layer using Ru and Cr which are indicated by these conventional technique was difficult for not necessarily attaining low noise-ization of a magnetic layer enough, although it was possible to have raised the crystal orientation of a magnetic layer to some extent to perpendicular orientation. Namely, although Ru is hexagonal close-packed structure as well as Co system magnetic layer, and crystal orientation can raise the perpendicular orientation of a magnetic layer to some extent also in an Ru independent substrate layer since it turns into the <00.1> direction when a thin film is created with a spatter, a vacuum deposition method, etc. As opposed to the lattice constant of the a-axis of Co which is the principal component of a magnetic layer being 0.251 [nm] From it being 0.271 [nm], the grid frequency of the a-axis of Ru which is the principal component of a substrate layer The lattice mismatch between the presentation ingredients of a magnetic layer and a substrate layer became 7.2%, an Ru independent substrate layer was not necessarily enough for it to control turbulence of the crystal orientation at the time of initial growth of a magnetic layer, and low noise-ization of a magnetic layer was not able to realize it enough by this.
[0004] In order to make small the lattice mismatch between the presentation ingredients of such a magnetic layer and a substrate layer, how to use for a substrate layer the alloy which mixed Cr etc. with Ru can be considered. For example, using for the substrate layer of the magnetic layer of Co system the RuCr alloy with which the presentation of Cr becomes more than 30wt(s).% is indicated by JP,4-704,A.
[0005] It can make a lattice mismatch with a magnetic layer small, so that Cr which is one of the ingredients which take body-centered cubic structure forms Ru and an alloy, and it mixes many Cr(s) with Ru, since an atomic radius is also small. For this reason, with the conventional technique indicated by above-mentioned JP,4-704,A, the presentation of Cr of the substrate skin is specified more than as 30wt(s).%, therefore it has prescribed that the presentation of Ru is made below into 70wt(s).% (that is, equivalent to below about 55 at(s).%).
[0006] Although this is based on the idea to which it is supposed that turbulence of the crystal orientation at the time of initial growth of the magnetic layer containing Cr is mitigated so that many Cr components are contained in the substrate layer, it is considered that the presentation of Ru produces

turbulence of the crystal orientation of a magnetic layer on the contrary below in 55at(s).% like the above-mentioned conventional technique from a viewpoint of the crystal structure and crystal orientation by recent years. That is, since a RuCr alloy cannot maintain hexagonal close-packed structure, it makes it turbulence of the crystal orientation of a magnetic layer produced on the contrary, when the presentation of Cr becomes more than 40at(s).% (the presentation of Ru below 60at(s).%). Consequently, low noise-ization of a magnetic layer could not be realized enough, therefore a medium noise has not been improved.

[0007]

[Problem(s) to be Solved by the Invention] This invention has the configuration which is made in view of the above-mentioned situation, and maintains hexagonal close-packed structure in the substrate layer using the ingredient of Ru system, and maintains the crystal orientation in the <00.1> direction (that is, equivalent to perpendicular orientation), thereby, raises the perpendicular orientation of a magnetic layer and aims at offer the perpendicular MAG magnetic medium and vertical magnetic recording regenerative apparatus with which the medium noise has been improved.

[0008]

[Means for Solving the Problem] The vertical-magnetic-recording medium of this invention is characterized by for a magnetic layer consisting of an alloy which uses Co as a principal component, and being the alloy which uses as a principal component the ingredient with which a substrate layer has Ru and body-centered cubic structure, and including Ru more than 60at(s).%.

[0009] Moreover, a magnetic layer consists of an alloy which uses Co as a principal component, the vertical-magnetic-recording medium of this invention consists of the alloy or compound with which the first substrate layer uses Ti or Ti as a principal component, and said second substrate layer is the alloy which uses as a principal component the ingredient which has Ru and body-centered cubic structure, and is characterized by including Ru more than 60at(s).%.

[0010] Moreover, the vertical-magnetic-recording regenerative apparatus of this invention is characterized by for the vertical-magnetic-recording medium consisting of an ingredient with which a magnetic layer uses Co as a principal component, and being the alloy which uses as a principal component the ingredient with which a substrate layer has Ru and body-centered cubic structure, and including Ru more than 60at(s).%.

[0011] Moreover, the vertical-magnetic-recording medium consists of an alloy with which a magnetic layer uses Co as a principal component, the vertical-magnetic-recording regenerative apparatus of this invention consists of the alloy or compound with which the first substrate layer uses Ti or Ti as a principal component, and said second substrate layer is the alloy which uses as a principal component the ingredient which has Ru and body-centered cubic structure, and is characterized by including Ru more than 60at(s).%.

[0012] It becomes possible by raising the perpendicular orientation by improving a lattice mismatch with a magnetic layer and controlling turbulence of crystal **** at the time of initial growth of a magnetic layer by such configuration, maintaining a substrate layer or the second substrate layer at hexagonal close-packed structure and <00.1> orientation, and realizing detailed-izing of the crystal grain in a magnetic layer, and equalization of particle size to reduction-ize a medium noise.

[0013]

[Embodiment of the Invention] (1st operation gestalt) With reference to a drawing, the gestalt of operation of this invention is explained hereafter.

[0014] In the substrate layer using the ingredient of Ru system, in order to maintain hexagonal close-packed structure and to maintain the crystal orientation in the <00.1> direction equivalent to perpendicular orientation, it turns out that an upper limit exists in the concentration of the ingredient of body-centered cubic structures, such as Cr mixed with Ru. According to the binary alloy state diagram, in Cr, in a room temperature, the upper limit of concentration is about 40at(s).%, the lattice constant of the RuCr alloy of the substrate layer at this time is set to about 0.262 [nm], and the lattice mismatch with Co of a magnetic layer can be made small to about 4.4%. therefore, the thing for which the alloy which uses as a principal component the element which has Ru and body-centered cubic structure as a substrate

layer, and contains Ru more than 60at(s).% is used -- the turbulence of the crystal orientation at the time of initial growth of a magnetic layer -- controlling -- the perpendicular orientation -- ********** -- things are made and the vertical-magnetic-recording medium which has therefore improved the medium noise of a magnetic layer can be realized. Especially, in Cr, it is thought also by promoting the segregation of Cr in a magnetic layer more, and mitigating the interaction between magnetic particles that the medium noise is improved.

[0015] Moreover, there is V other than Cr as an ingredient which has body-centered cubic structure. V also forms Ru and an alloy, since the atomic radius was also small, as well as the substrate layer of a RuCr alloy when the substrate layer of a RuV alloy is used, turbulence of the crystal orientation at the time of initial growth of a magnetic layer can be controlled, the perpendicular orientation can be raised, and, therefore, an improvement can be expected for the medium noise of a magnetic layer. Furthermore, when the ingredient of body-centered cubic structure with which the crystal structures differ is mixed with Ru which is hexagonal close-packed structure, it is thought that the medium noise is improved by detailed-izing of crystal grain and the homogeneous improvement in particle size. For this reason, when Nb, Mo, Ta, W, etc. which are body-centered cubic structure the same besides Cr and V are mixed with Ru, although a lattice mismatch becomes larger than an Ru independent case, it can expect the improvement of a medium noise similarly.

[0016] Next, the vertical-magnetic-recording medium A of the 1st operation gestalt of this invention is explained.

[0017] The vertical-magnetic-recording medium A is considering the first substrate layer 2 of TiN, the second substrate layer 3 of RuCr, the first magnetic layer 4 of CoPtCrO, the RuCr interlayer 5, the second magnetic layer 6 of CoPtCrO, and the C protective layer 7 as the configuration which carried out the laminating one by one on the nonmagnetic substrate 1 as shown in drawing 1 .

[0018] This vertical-magnetic-recording medium A is the following, and is made and created. As a nonmagnetic substrate 1, DC magnetron sputtering performed all membrane formation of each class on this nonmagnetic substrate 1 using the glass substrate which fills the standard specifications of a 2.5 inch magnetic disk. First, the first substrate layer 2 of TiN of thickness 36 [nm] extent was formed by carrying out the spatter of the TiN compound target to the nonmagnetic substrate 1. Furthermore, on the first substrate layer 2 of TiN, the spatter of the Ru-10at.%Cr alloy target was carried out, and the second substrate layer 3 of RuCr of thickness 10 [nm] extent was formed. On this second substrate layer 3 of RuCr, sputtering of a CoPtCr alloy target was performed in Ar ambient atmosphere containing O2 of a minute amount, and the first magnetic layer 4 of CoPtCrO was formed. Furthermore, on the first magnetic layer 4 of CoPtCrO, the spatter of the Ru-10at.%Cr alloy target was carried out, and the RuCr interlayer 5 was formed. Furthermore, on the RuCr interlayer 5, the spatter of the CoPtCr alloy target was carried out in Ar ambient atmosphere containing O2 of a minute amount, and the second magnetic layer 6 of CoPtCrO was formed. Thus, the vertical-magnetic-recording layer of the laminated structure of the first magnetic layer 4 of CoPtCrO, the RuCr interlayer 5, and the second magnetic layer 6 of CoPtCrO was formed. Then, on the second magnetic layer 6 of CoPtCrO, the spatter of the C target was carried out and the C protective layer 7 of thickness 10 [nm] extent was formed.

[0019] By the vertical-magnetic-recording medium A in the 1st operation gestalt, as described above, on the occasion of formation of the second substrate layer 3 of RuCr, and the RuCr interlayer 5, Ru is made to contain the presentation by carrying out the spatter of the Ru-10at.%Cr alloy target more than 60at (s).%.

[0020] Next, the vertical-magnetic-recording medium B shown in drawing 2 was created as an example 1 of a comparison. This vertical-magnetic-recording medium B has the second substrate layer 13 of Ru, and the Ru interlayer 15, and the points which set the second substrate layer and the interlayer to Ru differ to the vertical-magnetic-recording medium A of drawing 1 . About layers other than this second substrate layer and an interlayer, it considered as the same configuration as the vertical-magnetic-recording medium A. Under the present circumstances, the vertical-magnetic-recording medium A of the 1st operation gestalt of this invention and the vertical-magnetic-recording medium B of the example 1 of a comparison were values with both the perpendicular square shape ratios near 1, and perpendicular

coercive force was more than 3.5 [kOe] (**276.5[kA/m]).
[0021] The head using a magneto-resistive effect is used about the vertical-magnetic-recording medium A of the 1st operation gestalt of this invention, and the vertical-magnetic-recording medium B of the example 1 of a comparison, and it is ******** about evaluation of record reproducing characteristics. Evaluation was performed by measuring the signal object noise ratio (So/Nm) of a medium to the spatter power of the second substrate layer creation time. The result of having plotted the measurement result to drawing 3 is shown. In drawing 3 , with a circle [white] shows the measured value of the vertical-magnetic-recording medium A, and the black dot shows the measured value of the vertical-magnetic-recording medium B. the regenerative-signal output of the vertical-magnetic-recording medium A and the vertical-magnetic-recording medium B -- **** -- since an equal value is taken, the thing which has a high signal-to-noise ratio (So/Nm) shows that a medium noise is low. As drawing 3 shows, irrespective of the spatter power of the second substrate layer creation time, the direction of the vertical-magnetic-recording medium A always shows the value of the signal-to-noise ratio (So/Nm) superior to the vertical-magnetic-recording medium B, and it turns out by the vertical-magnetic-recording medium A that reduction-ization of a medium noise is realized.
[0022] Furthermore, the vertical-magnetic-recording medium C shown in drawing 4 was created as an example 2 of a comparison. By this vertical-magnetic-recording medium C, it has the Ru interlayer 25 and the points which set the interlayer to Ru differ to account ****** A of the perpendicular MAG of drawing 1 . About layers other than an interlayer, it considered as the same configuration as the vertical-magnetic-recording medium A. In order to compare the vertical-magnetic-recording medium C of the example 2 of a comparison with the vertical-magnetic-recording medium A of this invention, the record reproducing characteristics using the head using a magneto-resistive effect were evaluated like the time of the comparison with the vertical-magnetic-recording medium B and the vertical-magnetic-recording medium A which were mentioned above. Consequently, medium noise figure with the vertical-magnetic-recording medium A of this invention lower than the vertical-magnetic-recording medium C of the example 2 of a comparison was able to be obtained. Therefore, it turns out that it has effectiveness in reduction-ization of a medium noise by setting the presentation to RuCr in which Ru is contained more than 60at(s).% also about the interlayer prepared between the first magnetic layer and the second magnetic layer.
[0023] Thus, reduction-ization of a medium noise can be attained by [its] it-forming by detailed-izing of crystal grain [in / for the second substrate layer 3 of RuCr and the RuCr interlayer 5 who considered as the presentation in which Ru is contained more than 60at(s).% as a substrate layer of the first magnetic layer 4 of CoPtCrO, and the second magnetic layer 6 of CoPtCrO / a magnetic layer], and equalization of particle size.
[0024] Moreover, since there are CoPt system alloys, such as CoPtO besides CoCr system alloys, such as CoCrPt and CoCrTa, and CoPtB, you may make it form the first magnetic layer and the second magnetic layer using these magnetic materials as a magnetic material which has the perpendicular magnetic anisotropy used for the first magnetic layer and the second magnetic layer.
[0025] Furthermore, by the vertical-magnetic-recording medium A of this invention, it is considering as the configuration which has the first substrate layer 2 of TiN under the second substrate layer 3 of RuCr, and the RuCr interlayer 5. Although Japanese Patent Application No. No. 171272 [11 to] for which this invention person applied has described this, by preparing Ti system substrate layer in the bottom of Ru substrate layer shows that it is effective, when improving the perpendicular orientation of a CoPtCrO magnetic layer, coercive force, and playback output ****. Therefore, since it is possible to give the same effectiveness to the magnetic layer described above as well as Ru substrate layer when Ti system substrate layer was prepared in the bottom of a RuCr substrate layer, by the vertical-magnetic-recording medium A of this invention, it is considering as the configuration which formed the first substrate layer 2 of TiN.
[0026] (2nd operation gestalt) Next, the 2nd operation gestalt of this invention is explained. The vertical-magnetic-recording medium D of the 2nd operation gestalt is shown in drawing 5 . Points with the first substrate layer of Ti of thickness 12 [nm] extent and the second substrate layer of RuCr of

thickness 50 [nm] extent differ to the vertical-magnetic-recording medium A of drawing 1 having the first substrate layer of TiN of thickness 38 [nm] extent, and the second substrate layer of RuCr of thickness 10 [nm] extent, as for this vertical-magnetic-recording medium D. The vertical-magnetic-recording medium D carried out the spatter of the Ti target about the first substrate layer 32 of Ti, was formed by the thickness of 12 [nm] extent, carried out the spatter of the Ru-10at.%Cr alloy target about the second substrate layer 33 of RuCr, and formed it by the thickness of 50 [nm] extent. About the same layer as vertical-magnetic-recording media A other than this, it formed like the vertical-magnetic-recording medium A.

[0027] As an example 3 of a comparison over the vertical-magnetic-recording medium D of the 2nd operation gestalt of this this invention, the magnetic magnetic-recording medium E shown in drawing 6 was created. By the vertical-magnetic-recording medium E, it has the second substrate layer 43 of Ru, and the Ru interlayer 45, and the points which set the second substrate layer and the interlayer to Ru differ to the vertical-magnetic-recording medium D of drawing 5 . About layers other than this second substrate layer and an interlayer, it considered as the same configuration as the vertical-magnetic-recording medium D. Under the present circumstances, the vertical-magnetic-recording medium D of the 2nd operation gestalt of this invention and the vertical-magnetic-recording medium E of the example 3 of a comparison were values with both the perpendicular square shape ratios near 1, and perpendicular coercive force was more than 3.5 [kOe] (**276.5[kA/m]).

[0028] In order to compare the vertical-magnetic-recording medium D of this invention with the vertical-magnetic-recording medium E of the example 3 of a comparison, the record reproducing characteristics using the head using a magneto-resistive effect were evaluated like the case where it mentions above. Consequently, medium noise figure with the lower vertical-magnetic-recording medium D of this invention was able to be obtained from the vertical-magnetic-recording medium E of the example 3 of a comparison. moreover -- although it turned out that turbulence of crystal orientation is not produced and the signal-to-noise ratio (So/Nm) was comparable at this time, since the same perpendicular square shape ratio and perpendicular coercive force were acquired also when Ru-30at.% Cr was used instead of Ru-10at.%Cr -- record -- resolution is improved and effectiveness was seen about improvement in surface recording density. Therefore, also when not TiN but Ti is used as the first substrate layer, reduction-ization of a medium noise can be attained by using RuCr considered as the presentation in which Ru is contained in the second substrate layer and an interlayer more than 60at (s).%.

[0029] (3rd operation gestalt) Next, the 3rd operation gestalt of this invention is explained. The vertical-magnetic-recording medium F of the 3rd operation gestalt is shown in drawing 7 . By this vertical-magnetic-recording medium F, it differs from the account key medium D of the perpendicular MAG of drawing 5 in that it has the CoZrNb soft magnetism layer 52 between the nonmagnetic substrate 51 and the first substrate layer 53 of Ti. Although this vertical-magnetic-recording medium F forms the CoZrNb soft magnetism layer 52 by carrying out the spatter of the CoZrNb target on the nonmagnetic substrate 51, the formation of each class other than this CoZrNb soft magnetism layer 52 of it is the same as that of the creation time of the vertical-magnetic-recording medium D.

[0030] Thus, when a soft magnetism layer is prepared between a nonmagnetic substrate and a nonmagnetic substrate layer, it functions as the so-called perpendicular bilayer medium, and is effective in bearing a part of magnetic head which makes the record field from the magnetic head flow back, and raising record regeneration efficiency. Even when it has the configuration which prepared such a soft magnetism layer, reduction-ization of a medium noise can be attained by using RuCr considered as the presentation in which Ru is contained more than 60at(s).% as a substrate layer of a recording layer.

[0031] as the ingredient of a soft magnetism layer -- NiFe system alloys, such as CoZr system alloys, such as CoZrNb, and a permalloy, a FeCo system alloy, and a FeSi system -- an alloy -- ** -- the soft magnetism alloy which has high permeability can be used. In addition, although it will be thought that it is easy to use amorphous ingredients, such as CoZrNb, as a soft magnetism layer if it takes into consideration that it is desirable to grow up the nonmagnetic substrate layer which uses a RuCr alloy and Ti as a principal component on a soft magnetism layer so that those maximum **** may become

parallel to a film surface, the C layer which is an amorphous ingredient may be instead prepared between a nonmagnetic substrate and a soft magnetism layer. Furthermore, for a ****** reason, hard magnetism layers, such as antiferromagnetism layers, such as FeMn, and CoSm, may be formed in radial [of a medium / the circumferencial direction or radial] for the easy axis of a soft magnetism layer between a nonmagnetic substrate and a soft magnetism layer.

[0032] Moreover, in account ******F of the perpendicular MAG, although Ti is used as an ingredient of the first substrate layer, TiN may be used like the vertical-magnetic-recording medium D of the 2nd operation gestalt.

[0033] In addition, by the vertical-magnetic-recording medium A of the 1st operation **** mentioned above, the vertical-magnetic-recording medium D of the 2nd operation gestalt, and the vertical-magnetic-recording medium F of the 3rd operation gestalt, although the glass substrate is used as a nonmagnetic substrate, Si single crystal substrate with which the alloy substrate or front face of aluminum system oxidized, a ceramic substrate, a plastic plate, etc. may be used. Furthermore, that by which plating of a NiP alloy etc. was performed to these nonmagnetic substrate front face may be used. Moreover, although only the sputtering method was taken up as a forming-membranes method, you may make it create with a vacuum deposition method etc.

[0034] (4th operation gestalt) Next, with reference to drawing 8 , the vertical-magnetic-recording regenerative apparatus using the vertical-magnetic-recording medium of this invention mentioned above is explained.

[0035] The vertical-magnetic-recording medium 61 is the vertical-magnetic-recording medium A, the vertical-magnetic-recording medium D, or the vertical-magnetic-recording medium F of this invention. The spindle 62 is equipped with this vertical-magnetic-recording medium 61, and a rotation drive is carried out at a fixed rotational frequency with the spindle motor which is not illustrated. The slider 63 in which the magnetic head which accesses the vertical-magnetic-recording medium 61 and performs record playback of a signal was carried is attached at the tip of the suspension 64 which consists of a sheet metal-like flat spring. The suspension 64 is connected to the end side of the arm 65 which has the bobbin section holding the drive coil which is not illustrated etc.

[0036] The voice coil motor 66 which is a kind of a linear motor is formed in the other end side of an arm 65. The voice coil motor 66 consists of a drive coil which was able to be wound up in the bobbin section of an arm 65 and which is not illustrated, and a magnetic circuit constituted by the permanent magnet and opposite York which have been opposed and arranged so that it may be put.

[0037] An arm 65 is held by the ball bearing which was prepared in two upper and lower sides of the fixed shaft 67 and which is not illustrated, and a rotation rocking drive is carried out with a voice coil motor 66. That is, the location of the slider 63 on the vertical-magnetic-recording medium 61 is controlled by the voice coil motor 66. Moreover, 68 shows the lid.

[0038] Thus, it is possible by using the account saddle medium A of the perpendicular MAG of this invention, the vertical-magnetic-recording medium D, or the vertical-magnetic-recording medium F for the vertical-magnetic-recording medium 61 to realize the low vertical-magnetic-recording regenerative apparatus of a medium noise.

[0039]

[Effect of the Invention] Maintaining at hexagonal close-packed structure and <00.1> orientation the substrate layer or the second substrate layer which consists of an Ru system alloy in this invention, as explained in full detail above It becomes possible by raising the perpendicular orientation by improving a lattice mismatch with a magnetic layer and controlling turbulence of the crystal orientation at the time of initial growth of a magnetic layer, and realizing detailed-izing of the crystal grain in a magnetic layer, and equalization of particle size to reduction-ize a medium noise.

[0040] Moreover, when a magnetic layer is the multilayer structure which has an interlayer between the first magnetic layer and the second magnetic layer, it sets. Maintaining at hexagonal close-packed structure and <00.1> orientation the interlayer who consists of an Ru system alloy It becomes possible by raising perpendicular orientation by improving a lattice mismatch with the second magnetic layer, and controlling turbulence of the crystal orientation at the time of initial growth of the second magnetic

layer, and realizing detailed-izing of the crystal grain in the second magnetic layer, and equalization of particle size to reduction-ize a medium noise.

[Translation done.]

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	36879	(cu copper).clm.	US-PGPUB	OR	OFF	2006/12/20 15:42
L2	1499	(soft adj (magnetic underlayer)).clm.	US-PGPUB	OR	ON	2006/12/20 15:43
L3	214	1 and 2	US-PGPUB	OR	ON	2006/12/20 15:43
L4	13	(rucr ru-cr crru cr-ru).clm.	US-PGPUB	OR	ON	2006/12/20 15:43
L5	3	3 and 4	US-PGPUB	OR	ON	2006/12/20 15:56
L6	10	4 not 5	US-PGPUB	OR	ON	2006/12/20 15:56

Interference Search

H. Rickman

12/20/06